

# Comparison of STM and Hamamatsu SiPM's

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## Abstract

Timing resolutions for the PET-TOF experimental set-up are studied using both STM and Hamamatsu SiPM's. Studying the effect of clipped capacitance in set-ups using these SiPM's supports earlier studies showing that clipping capacitance improves timing resolution.

## Introduction

We took data for four different set-ups. For each,  $3 \times 3 \times 15 \text{ mm}^3$  LYSO crystals were used along with the *DRS4* analyzer. The only difference between each data run was the SiPM's used.

- Run 1: MPPC with 10pf capacitance.
- Run 2: MPPC without capacitance.
- Run 3: STM with 10pf capacitance.
- Run 4: STM without capacitance.

## Results

*Figures 1 & 2* are the normalized pulse shapes for the Hamamatsu and STM SiPMs, each with 10 pf capacitances, respectively. The leading edges of these pulses are best described using a gaussian fit. *Figures 3 & 4* are the normalized pulse shapes for the Hamamatsu and STM SiPMs, each without capacitance, respectively. The leading edges are best described using an exponential fit. Only events from the photo-peak were used to evaluate the timing resolution. The results are summarized in *Table 1*.

## Conclusions

For the MPPC SiPM's with clipped capacitance, it has been shown that a timing resolution of  $\sigma \sim 100ps$

SiPM	Capacitance( $pF$ )	$\sigma(ps)$
MPPC	10	120
MPPC	0	150
STM	10	153
STM	0	270

Table 1: Summary of results

is attainable. However, even with these results it is evident that using MPPC over STM improves resolution. Further, these results also demonstrate that using clipped capacitance improves resolution. This is consistent with what is expected, as we suspect that clipping capacitance improves the rise time,  $t_{rise}$ . Given

$$\sigma \sim \frac{t_{rise}}{SNR} \quad (1)$$

it is clear that this will improve the timing resolution.

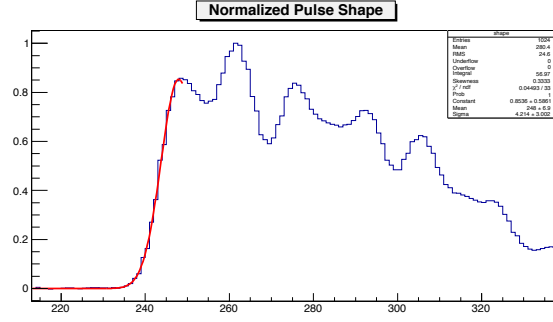


Figure 1: Normalized pulse shape for the Hamamatsu SiPM with 10 pf capacitance (blue). The leading edge is fitted with a gaussian (red)

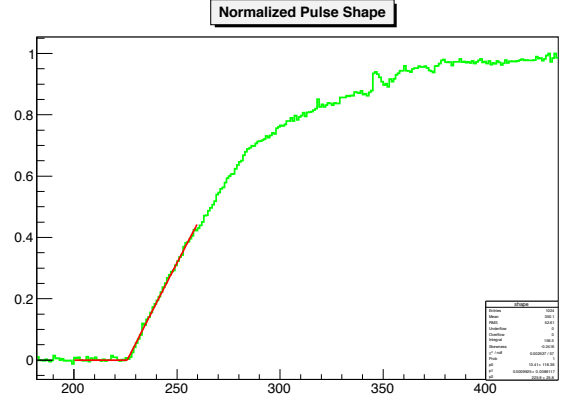


Figure 3: Normalized pulse shape for the Hamamatsu SiPM without capacitance (green). The leading edge is fitted with an exponential (red)

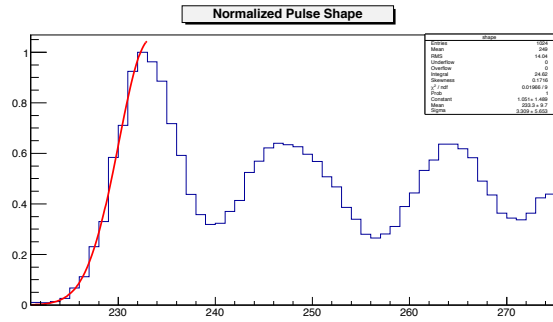


Figure 2: Normalized pulse shape for the STM SiPM with 10 pf capacitance (blue). The leading edge is fitted with a gaussian (red)

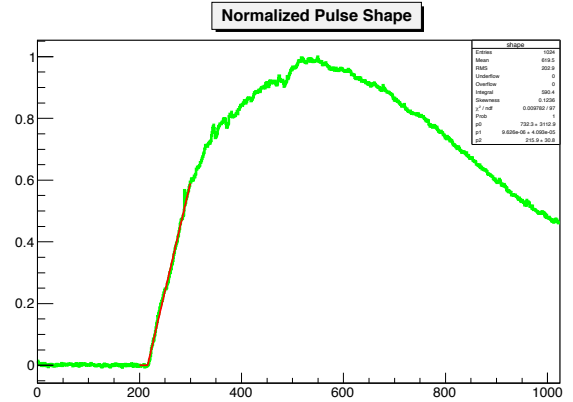


Figure 4: Normalized pulse shape for the STM SiPM without capacitance (green). The leading edge is fitted with an exponential (red)